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Self-control, financial literacy & the co-holding puzzle☆,☆☆

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ABSTRACT

We use UK survey data to analyze the puzzling co-existence of high cost revolving consumer credit alongside low yield liquid savings in household balance sheets, which we name the 'co-holding puzzle'. Approximately 12% of households in our sample co-hold, on average, £3800 of revolving consumer credit on which they incur interest charges, even though they could immediately pay down all this debt using their liquid assets. Co-holders are typically more financially literate, with above average income and education. In most estimates co-holding is also associated with impulsive spending behavior on the part of the household. Our results provide empirical support to theoretical models in which households co-hold as a means of managing self-control problems.

1. Introduction

Why do consumers simultaneously hold high cost credit and low yield liquid assets? In US data, Gross and Souleles (2002) find 33% of individuals with credit card debt have at least two months of disposable income available in liquid savings. This co-existence of liquid assets and consumer debt has also been shown in a number of other studies using US data (Telyukova and Wright, 2008; Telyukova, 2013; Bertaut et al., 2009; Fulford, 2012). Correspondingly, using UK data, we find that 12% of UK households hold, on average, £3800 of revolving credit on multiple credit products for which they incur interest charges even though they could immediately pay down all this debt using their liquid assets (and with a month's income in liquid assets to spare). By 'co-holding' credit and assets, these households incur on average approximately £650 ($1050) in unnecessary interest charges per annum. One-in-five 'co-holders' incur £1000 ($1600) in interest charges per annum due to co-holding.

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What explains this failure to make a simple money-saving arbitrage between assets and debt? Households may hold liquid savings to transact purchases for which consumer credit cannot be used such as mortgage or rent payments (Telyukova and Wright, 2008; Telyukova, 2013) or because credit limits, if paid down, might be withdrawn (Fulford, 2012). A related explanation is that liquid savings might be held as insurance against unanticipated household expenses. Other reasons may be that households are untroubled by this loss, or that co-holding arises due to (optimal) limited attention or mental accounting and the 'pain of paying' from savings (Prelec and Loewenstein, 1998).

The explanation which we explore in this paper is that consumers co-hold due to particular behavioral biases in their decision making. We focus on two sources of behavioral biases: poor financial literacy and lack of self-control. First, less financially literate individuals may not realize the existence of arbitrage opportunities and hence not recognize that co-holding is a costly activity. Disney and Gathergood (2013) show poor financial literacy is associated with higher cost consumer credit portfolios. Recent studies have shown that lack of financial literacy leads to a range of other sub-optimal financial outcomes including under-saving and suboptimal portfolio allocations (Lusardi and Mitchell, 2007; Lusardi and Tufano, 2009; van Rooij et al., 2011a,b).

Second, lack of self-control and impulsive spending behavior might explain co-holding. Impulsive consumers may engage in spending mistakes at the point-of-sale (for example in shops or via online shopping) using their credit card, store card or mail order account while, at the same time, holding monies in savings accounts or other savings products not available at point of sale. However, persistent co-holding might actually be explained as a form of self-control management whereby consumers deliberately restrict their available-to-spend liquidity at point-of-sale by holding high utilization rates on consumer credit, so limiting the opportunity for impulsive spending mistakes.

The idea of co-holding as self-control management is developed in the dual-self model of Bertaut et al. (2009) in which one patient entity of the 'inner-self' controls a less patient entity by restricting access to credit via high utilization so as to control credit liquidity. In this so-called 'accountant-shopper' framework, a patient 'accountant' self who manages the finances of the household and has sole access to liquid savings with which to pay down credit, decides to revolve debt in order to restrict the consumption opportunities of an impatient 'shopper' self who cannot access savings and is reliant on the credit decisions of the accountant. Bertaut et al. (2009) show that a stable equilibrium exists in which savings and credit are held simultaneously by the accountant-shopper. In their model the accountant-shopper either constitutes a two-person household or a single self-aware individual who undertakes planning behavior as an accountant to restrict the consumption opportunities they will be tempted to indulge in as a shopper. Thus, by making one's savings less accessible and non-spendable for immediate consumption, consumers minimize their vulnerability to impulsive spending by maintaining revolving consumer credit debt simultaneously with savings.

We present empirical evidence on the importance of behavioral characteristics to co-holding, focusing on financial literacy, self-control and related behaviors in explaining levels of co-holding among a representative sample of UK households. Our survey data provides access to a broad range of questions together with detailed information on household finances, demographics and other respondent characteristics.

Our results show that among a representative sample of households, co-holding is not associated with poor financial literacy or lack of education, but is associated with lack of self-control. Co-holders perform above-average when answering financial literacy questions. Also, co-holders are mostly of working age and have above average levels of education, employment and household income. However, co-holders self-report high rates of impulsive spending behavior. Multivariate probit estimates show impulsiveness predicts co-holding in the majority of our models. This result is robust to controls for time preference (i.e. patience), perceived income risk and alternative measures of the cost of co-holding. Our findings are consistent with the suggestion that co-holding is a planned behavior of the type modeled in Bertaut et al. (2009).

We make the following new contributions to the literature: firstly, we provide new evidence on the characteristics of co-holders. We show that co-holding households have relatively complex portfolios of consumer credit, including credit cards, installment loans and flexible options such as overdrafts. Co-holding households hold a range of credit items which could be repaid or pre-paid without incurring financial charges.

Secondly, using econometric models, we find that self-control positively predicts co-holding. Our models control for a broad set of covariates and test the sensitivity of our analysis to different levels of co-holding. In our sample, in which approximately one quarter of co-holding households report impulsive spending behavior, estimates imply that a household which exhibits impulsiveness in spending decisions is approximately 70% more likely to co-hold at least £1000 of consumer credit. Estimates also imply that among co-holders impulsiveness is associated with co-holding approximately £3100, on average, equivalent to foregoing £550 in interest payments per annum. We test the robustness of our findings to a variety of specifications.

Thirdly, we compare co-holding behavior with households that are exclusively either borrowers, savers or those that neither save nor borrow. This allows us to compare behavioral characteristics of co-holders with households that have different types of financial market participation. Results show self-control positively predicts co-holding compared with saving or holding neither assets or debt. Self-control does not predict co-holding compared with borrowing, but financial literacy does raise the likelihood of co-holding. Savers and co-holders are indistinct with regards to financial literacy, but co-holders exhibit significantly less self-control.

Fourthly, we incorporate self-reported measures of income risk into the analysis and show that co-holding is not explained by anticipated future income variability which might induce precautionary saving behavior on the part of the household

in the face of perceived income risk. Co-holders self-report rates of expected unemployment similar to non-co-holders and average rates of expected future additional credit use below those of borrowers.

Our results do not provide a complete explanation for co-holding or unambiguous support for the Bertaut et al. (2009) accountant-shopper model. Instead, they show that behavioral characteristics are important in explaining some of the observed prevalence of co-holding in the data.[1] In doing so, this paper contributes to the existing literature on whether consumers behave rationally in credit markets (Bernheim, 1995; Campbell, 2006; Agarwal et al., 2006, 2009). Our results are also relevant to the literature on financial literacy and individual behavior (Bernheim, 1998; Lusardi, 2008; Jappelli, 2010) and more generally to the literature on the role of self-control problems in shaping individual behavior related to financial decision making (Strotz, 1955; Thaler and Shefrin, 1981; Laibson, 1997; Gul and Pesendorfer, 2001; Benhabib and Bisin, 2005; Fudenberg and Levine, 2006; Heidhues and Kőszegi, 2010).

2. Data

2.1. Sample summary statistics and measure of co-holding

Our data source is the YouGov Debt Tracker survey of household finances, also used in Disney and Gathergood (2013). The Debt Tracker is a quarterly cross-sectional survey of a representative sample of approximately 2500 UK households conducted via the Internet. YouGov makes special provisions for non-internet users such that their survey sample is representative of the population as a whole. The core survey includes approximately 85 questions which cover in detail household finances, demographics, education, labor market situation and financial product use. We use data from the October 2010 survey.

Summary statistics for our sample of households are provided in Table 1. Column 1 reports mean values for the whole sample of 2584 households. Half of all respondents are male, two thirds married and one fifth have dependent children. 59% of households have a respondent in employment, with 43% having the respondent's partner in full-time employment. 70% of households are home-owners. Mean household income is £35,600 with median income at £30,000.

Table 1 also provides summary statistics for household borrowing and savings. For consumer borrowing the survey data contains individual balances on an exhaustive range of consumer credit products, including commonly held products such as credit cards, personal loans and store cards, but also less common forms of borrowing such as mail order and hire-purchase loans. The data include the value of outstanding debt for each product type; excluding non-revolving balances which would be repaid within the current payment period without incurring interest charges (such as within-month balances on credit and store cards). We sum the value of individual balances on each consumer credit product to give a value for total outstanding revolving consumer credit that incurs interest. This measure excludes mortgage debt. Among our whole sample (Column 1) the mean value of consumer credit debt is just above £2000.

Our measure of saving is a self-reported measure of liquid savings based on a specific survey question. We use this approach as for measuring co-holding our interest is in the level of liquid savings available to the household which could be used to pay down consumer credit balances. Detailed data on savings and investments by product is not available in the survey. The total value of liquid savings we use is derived from a survey question in which respondents were asked to state the value of their non-pension savings which could be accessed easily:

- 'How much do you [and your partner] have in liquid savings? These are savings that could easily be used in an emergency and are not tied up in a pension or long term savings product.'

This question is designed to identify revolving financial assets by the phrase 'savings' and not deposit- or current account balances held between salary/benefit payment periods. The value of liquid savings we use is based on the respondents' own judgment about the liquidity of their savings and investments. The use of 'emergency funds' as a measure of liquid savings has been conceptualized by Johnson and Widdows (1985), who define it as very liquid assets including money market funds, savings- and checking accounts. The mean value among our whole sample is £9211. This compares with mean savings account balances reported by households in the UK 'Wealth and Assets Survey' (WAS) of £8700 (comprising £5900 held in standard savings accounts and £2800 in tax-exempt 'Individual Savings Accounts'). The distribution of savings across age and income brackets in our data also matches the distribution in the WAS closely.

Table 1 also provides summary statistics for four household types: 'borrower', 'saver', 'neither borrower nor saver' and 'co-holder'. All households in the survey are classified as (exactly) one of these types based on values of consumer borrowing and liquid savings. Co-holders are defined as households with a positive value of liquid savings who also hold a positive value of total consumer credit at the same time. To account for liquidity needs, following Gross and Souleles (2002), we allow for liquid savings to a value of one month's disposable income, which we calculate at the individual household level, and deduct this value from reported liquid savings when calculating co-holding balances. We do so because respondents may report within-period deposit account balances as savings, or because households might hold liquid savings against

[1] Indeed, the accountant-shopper model of Bertaut et al. (2009) matches the observed wealth distribution in US data only under the assumption of differential time preference in addition to lack of self-control, suggesting self-control alone cannot itself explain the co-holding puzzle.

Table 1
Sample characteristics by financial market participation.

	Sample	Borrower	Saver	Neither borrower nor saver	Co-holder
Age					
18–24	0.07	0.08	0.08	0.07	0.03
25–34	0.19	0.26	0.18	0.16	0.20
35–44	0.20	0.25	0.18	0.17	0.22
45–54	0.18	0.22	0.15	0.18	0.22
55+	0.36	0.19	0.41	0.43	0.33
Demographics					
Male (=1)	0.50	0.43	0.53	0.50	0.54
Married/living as married (=1)	0.67	0.69	0.64	0.67	0.77
Dependent children (=1)	0.20	0.32	0.16	0.17	0.22
Education leaving age	18.92	18.71	19.32	18.59	18.99
Employment					
Employed (=1)	0.59	0.71	0.55	0.51	0.70
Unemployed (=1)	0.04	0.04	0.03	0.05	0.03
Retired/student/housewife/disabled	0.37	0.25	0.42	0.43	0.27
Spouse employed (=1)	0.43	0.52	0.37	0.41	0.55
Housing					
Homeowner without mortgage (=1)	0.29	0.10	0.37	0.34	0.24
Homeowner with mortgage (=1)	0.41	0.47	0.38	0.36	0.55
Household finances					
Household income (£)	35,579	35,172	37,973	30,685	42,869
	(30,000)	(32,000)	(32,000)	(28,000)	(35,000)
Disposable household income (£)	15,923	15,179	18,036	12,881	19,316
	(13,739)	(13,212)	(15,630)	(11,400)	(16,560)
Liquid savings (£)	9211	117	21,577	0	12,079
	(0)	(0)	(10,000)	(0)	(6000)
Consumer credit debt (£)	2036	6943	0	0	6191
	(0)	(3100)	(0)	(0)	(4000)
Co-holding (£)	462	105	0	0	3821
	(0)	(0)	(0)	(0)	(2500)
Credit constrained (=1)	0.09	0.22	0.04	0.07	0.10
Income and expenditure risk					
Expects to be unemployed (=1)	0.08	0.09	0.08	0.07	0.09
Likely to borrow more in future (=1)	0.09	0.20	0.04	0.07	0.10
Behavioral characteristics					
Literacy score (0–3)	1.90	1.75	2.12	1.71	1.99
Impulsive spender (=1)	0.13	0.26	0.07	0.10	0.22
Heavy discounter (=1)	0.09	0.17	0.06	0.07	0.12
Observations	2584	491	933	861	299

Note: Mean values reported, medians in parentheses for financial variables.

within-month liquidity needs or on a precautionary basis. We calculate the amount of co-holding for each household. In total, 350 households hold liquid savings and consumer credit at the same time. Net of one month's disposable income (on average 45% of gross income), this number falls to 299, which we define as the co-holding group.

Co-holders can be classified into two types based on the relative size of their liquid savings and consumer credit debt. Firstly, some co-holding households hold net liquid saving balances in excess of their consumer credit balances and so could pay down all their consumer credit balance with savings to spare. Secondly, other co-holding households hold net liquid savings balances below their consumer credit balances and so could only partly pay down their consumer credit balance if they used all of their liquid savings. In our data, 199 households are of the first type and 100 are of the second type. The mean value of co-holding within the co-holders group is £3800 with the median value £2500. We define the amount of co-holding as the minimum of positive consumer credit and positive liquid savings (minus one month's disposable income).

For the other groups, borrowers are defined as households with non-zero total consumer credit balances and liquid savings of less than one month's disposable income (51 of these hold savings above zero). Mean consumer credit debt among borrowers is £6900 and the median is £3100. Savers are defined as households with non-zero liquid savings and zero consumer credit balances. Mean savings among savers is £21,500 with median £10,000.

The group 'neither borrowers nor savers' is defined as households with zero reported liquid savings and zero reported consumer credit balances. Although these households report zero balances for both savings and debt, we might expect that they hold some form of savings whether in cash or in small values of revolving deposit account end-of-month surpluses. However, we choose not to combine this group with savers as their reported liquid savings are zero and among this group average income is 20% lower than that of savers. But, combining this group with savers in the econometric analysis does not change our results. We also report estimates from specifications which combine the two groups later in the analysis.

2.2. Survey data on behavioral characteristics

We are able to supplement the core YouGov survey with our measures of behavioral characteristics. Our survey includes three financial literacy questions based on Lusardi and Tufano (2009), responses to which are used as a measure of financial literacy on the part of the respondent. These test respondents' ability to make a simple interest calculation, show they understand interest compounding and can correctly evaluate the impact of minimum payments on a credit card contract. Each of the questions was framed in the context of a choice over a consumer credit product and focused on a core concept in consumer credit finance. The questions were constructed using a multiple-choice format:

Simple Interest Question:

1. 'Cheryl owes £1000 on her bank overdraft and the interest rate she is charged is 15% per year. If she didn't pay anything off, at this interest rate, how much money would she owe on her overdraft after one year?'

• £850 • £1000 • £1150 • £1500 • Do not know

Compound Interest Question:

2. 'Sarah owes £1000 on her credit card and the interest rate she is charged is 20% per year compounded annually. If she didn't pay anything off, at this interest rate, how many years would it take for the amount she owes to double?'

• Less than 5 years
• Between 5 and 10 years
• More than 10 years
• Do not know

Minimum Payments Question:

3. 'David has a credit card debt of £3000 at an Annual Percentage Rate of 12% (or 1% per month). He makes payments of £30 per month and does not gain any charges or additional spending on the card. How long will it take him to pay off this debt?'

• Less than 5 years
• Between 5 and 10 years
• More than 10 years
• None of the above, he will continue to be in debt
• Do not know

We also included a survey instrument to elicit self-control problems on the part of the respondent. We use the approach of Ameriks et al. (2003, 2007) by using Likert scale responses by which individuals associate or disassociate themselves with a short statement which describes impulsive behavior. This approach is dependent upon self-awareness on the part of the respondent. We label this question 'impulsive spending' and assign a value of one if the respondent answers 'agree strongly' or 'tend to agree' and a value of zero otherwise:

Impulsive spender:

• 'I am impulsive and tend to buy things even when I can't really afford them'

(a) Agree strongly
(b) Tend to agree
(c) Neither agree nor disagree
(d) Tend to disagree
(e) Disagree strongly
(f) Do not know

Our survey data also contains a separate question on respondent spending behavior relating to time preference for consumption. We use responses to this question to identify impulsive spending behavior due to lack of self-control (time inconsistency) from a strong preference on near-term consumption (time preference). We label this question 'heavy discounter', again assigning a value of one is the respondent answers 'agree strongly' or 'tend to agree' and a value of zero otherwise:

Heavy discounter:

• 'I am prepared to spend now and let the future take care of itself'

(a) Agree strongly
(b) Tend to agree
(c) Neither agree nor disagree
(d) Tend to disagree
(e) Disagree strongly
(f) Do not know

In addition to these questions on behavioral characteristics we also make use of data from the survey on income risk to control for income risk which might induce the household to hold additional precautionary liquid savings. We measure income risk based on the self-reported likelihood of respondents facing unemployment in the near future. We label this

question 'expects to be unemployed' and assign a value of one if the respondent answers 'very likely' or 'fairly likely' and a value of zero otherwise:

Unemployment risk:

- 'How likely or unlikely do you think it is that you will be made redundant or become unemployed over the next 6 months?'

(a) Very likely
(b) Fairly likely
(c) Neither likely or unlikely
(d) Fairly unlikely
(e) Very unlikely
(f) Do not know

We also incorporate a self-reported measure of the likelihood of needing to draw upon credit in the near future, possible answers and our coding of which are the same as for the unemployment risk question above, which we label 'likely to borrow more in future':

Borrowing risk:

- 'In the near future how likely or unlikely is it that you will need to borrow any more money over the next 3 months?'

Finally, we create an indicator measuring the credit constraints a household faces in order to distinguish whether households are restrained in their borrowing capacity. This dummy takes the value one if respondents state 'yes' in response to at least one of the following descriptors: 'financial circumstances have got worse: can't get credit'; 'credit card withdrawn'; 'credit limit reduced'; 'overdraft withdrawn'; 'applied for a particular credit product and the outcome is either 'credit amount was less than wanted' or 'turned down'. We label this variable 'credit constrained'.

2.3. Behavioral characteristics and co-holding

In this section we provide summary statistics on the relationship between household behavioral characteristics and co-holding. The main insight from these summary statistics is that, compared with other types, co-holders are more financially literate than borrowers, but they also report high rates of impulsive spending behavior compared with other household types.

From Table 1, among co-holders the mean literacy score (number of financial literacy questions answered correctly) is 1.99, which is 5% higher than the sample average and approximately 15% higher than the mean scores for borrowers and the 'neither/nor' group. The socio-economic characteristics of co-holders are in keeping with their higher literacy scores. Compared with the whole sample, co-holders are typically more likely to be married, in employment plus have a partner in employment and to be home-owners with mortgages.

Co-holders also have the highest mean income among the four groups (20% higher than the sample average and 22% higher than households who borrow but hold no liquid savings) and higher than average balances of both liquid savings and consumer credit. Also, co-holders are only slightly more likely to self-report that they are credit constrained (10%) compared with the whole sample (9%). Borrowers report much higher rates of being credit constrained (22%).

Among the co-holding group, 22% of respondents strongly agreed or agreed with the statement that they are impulsive spenders. This proportion of impulsive spenders among the co-holding group is 9 percentage points higher than the whole sample average and more than three times that among savers and twice that among 'neither/nor' respondents. Among borrowers, the proportion of respondents who report being impulsive spenders is 4% higher than among co-holders.

More detailed summary statistics for households broken down by the level of household co-holding are presented in Table 2. These reveal that higher levels of co-holding, and higher levels of more costly co-holding (which we define below) are associated with both better financial literacy but also higher likelihood of being an impulsive spender. The first two columns of Table 2 report summary statistics for co-holders by their amount of co-holding.

Among the 299 co-holding households, 136 households co-hold between £250 and £2000 of consumer credit debt and liquid savings and 163 co-hold more than £2000. Among the larger co-holders, the mean literacy score is 0.21 points higher and the proportion of impulsive spenders 4% larger. Mean household income among that group is also 48% higher than among the smaller co-holders.

The second two columns of Table 2 separate co-holders by the financial cost of their co-holding. We estimate the financial cost of co-holding using household level credit portfolio data. Most households in the sample hold multiple consumer credit products. Table 3 provides summary statistics for consumer credit portfolios of co-holding households. Average balances for individual credit products among credit portfolios of co-holding households reveal much heterogeneity as they contain a wide variety of credit products, not just credit card debt. While credit card debt is on average the largest credit product type, personal loans and car loans also constitute sizeable amounts to the average portfolio.

To calculate the interest cost of co-holding we first attach product-specific 'Annualized Percentage Interest Rates' (APRs) to each product type held by households. The product-specific APRs are representative APRs derived from a monthly data series provided by the 'Financial and Leasing Association' (FLA), the UK industry body for the consumer credit industry. Assuming that households would pay down their most expensive consumer credit products first, we can calculate the

Table 2
Sample characteristics by co-holding.

	(1) Co-holding		(2) Co-holding cost	
	£250–£2000	>£2000	£100–£500	>£500
Age				
18–24	0.05	0.01	0.04	0.01
25–34	0.21	0.19	0.22	0.18
35–44	0.15	0.28	0.15	0.30
45–54	0.24	0.20	0.23	0.21
55+	0.34	0.32	0.35	0.30
Demographics				
Male (=1)	0.47	0.60	0.49	0.59
Married/living as married (=1)	0.74	0.80	0.76	0.78
Dependent children (=1)	0.15	0.28	0.15	0.30
Education leaving age	18.74	19.21	18.80	19.23
Employment				
Employed (=1)	0.68	0.71	0.68	0.72
Unemployed (=1)	0.03	0.03	0.03	0.03
Retired/student/housewife/disabled	0.29	0.26	0.29	0.25
Spouse employed (=1)	0.51	0.58	0.54	0.56
Housing				
Homeowner without mortgage (=1)	0.26	0.22	0.27	0.20
Homeowner with mortgage (=1)	0.48	0.61	0.49	0.62
Household finances				
Household income (£)	34,000	50,269	36,728	50,329
	(30,000)	(45,000)	(32,000)	(45,000)
Disposable household income (£)	15,102	22,833	16,447	22,802
	(13,892)	(20,314)	(14,894)	(20,314)
Liquid savings (£)	8651	14,938	10,485	14,014
	(5000)	(8000)	(5000)	(7500)
Consumer credit debt (£)	2816	9006	3090	9958
	(1320)	(6830)	(1700)	(8000)
Co-holding (£)	1207	6001	1609	6507
	(1000)	(5000)	(1300)	(5000)
Credit constrained (=1)	0.10	0.10	0.08	0.13
Income and expenditure risk				
Expects to be unemployed (=1)	0.08	0.10	0.09	0.10
Likely to borrow more in future (=1)	0.12	0.08	0.09	0.11
Behavioral characteristics				
Literacy score (0–3)	1.88	2.09	1.96	2.04
Impulsive spender (=1)	0.20	0.24	0.20	0.25
Heavy discounter (=1)	0.10	0.14	0.09	0.16
Observations	136	163	164	135

Definitions:
(1) 'Co-holding' is constructed as the minimum of liquid savings (minus one month's disposable income) and consumer credit.
(2) 'Co-holding cost' is calculated as the incurred credit charge plus interest foregone by co-holding.
Note: Mean values reported, medians in parentheses for financial variables.

Table 3
Consumer credit portfolios for co-holders.

	Co-holding £250–£2000	Co-holding > £2000
Consumer credit debt (£)	2816	9006
Credit card (£)	1472	2696
Store card (£)	72	98
Personal loan (£)	360	2820
Overdraft (£)	383	634
Hire-purchase agreement (£)	160	400
Car loan (£)	257	2067
Mail order catalog (£)	49	21
Other loan (£)	50	260
Observations	136	163

Note: Mean values reported.

annualized interest cost of co-holding for each household.[2] 164 co-holding households in our sample incur interest costs between £100 and £500 per annum. 135 co-holding households incur annual interest costs in excess of £500 per annum.

Households in the higher-cost co-holding group have higher mean financial literacy scores (0.08 points difference) plus a 5% higher proportion of being impulsive spenders compared with the lower cost co-holding group. Higher-cost co-holders also have higher mean household income (37% higher) and higher rates of home ownership (6 percentage points).

3. Econometric results

The summary statistics from the previous section indicate that co-holding households are more likely to report self-control problems and also exhibit higher levels of financial literacy, especially compared with borrowers. However, cross-group comparisons show households of the different types also differ in terms of demographic-, income- and other characteristics. We now present estimates from a series of multivariate econometric models which condition on these covariates.

First, we estimate a series of models which explain an 1/0 indicator variable for co-holding (a dichotomous dummy variable) as a function of behavioral characteristics, financial literacy and controls. The general form of the models we estimate is given in Eq. (1):

$$ch = \alpha_0 + \beta_1 imp + \beta_2 fil + \beta_3 dis + \mathbf{X}'\omega + u \tag{1}$$

where *ch* denotes a co-holding dummy, *imp* the impulsive dummy, *fil* the financial literacy score measured on a 0–3 scale and *dis* the heavy discounter dummy. The vector of control variables **X** includes the covariates shown in Table 1. Further controls and omitted control groups being described in the notes of the result tables. As the dependent variable is a 1/0 dummy variable we estimate Eq. (1) using a probit model. Subsequently, we also estimate a Tobit model to explain the level of co-holding and the cost incurred among co-holders.

3.1. Probit estimates

Our baseline estimates of Eq. 1 are shown in Table 4 which shows estimates for two specifications. In the first, the dependent variable is a 1/0 dummy variable indicating co-holding of at least £1000 (Column 1), in the second a 1/0 dummy variable indicating co-holding of at least £2000 (Column 2).

Turning first to covariates, results show no strong relationship between co-holding and age. In Column 1 younger households aged 18–24 are 0.075 percentage points less likely to co-hold compared with the omitted age group (44–55). Against a baseline probability of 9.8% this equates to a 77% reduction in likelihood. However, in our cross-sectional data we cannot distinguish age from cohort effects.

Among other covariates, the indicator variable for being a mortgaged homeowner is positive and statistically significant, the marginal effect implying mortgaged home owners are 38% more likely to co-hold. Compared to renters and outright homeowners, co-holding of mortgage holders may in part be related to liquid savings needs for refinancing or precaution for mortgage repayments. This may be relevant in our sample period (October 2010), during which uncertainties in the mortgage refinancing market and over the future path of mortgage interest rates were raised. These patterns in covariates are very similar in Column 2.

The coefficient on the financial literacy score is positive in both specifications, but not statistically significant. This indicates that there is no evidence for co-holding being associated with financial ignorance. The coefficient on the impulsive spender indicator variable is positive and statistically significant at the 1% level in both specifications. The magnitude of the marginal effect evaluated against the baseline probability is 69% in Column 1, 67% in Column 2. The very similar coefficient in the Column 2 specification shows the relationship between impulsiveness and co-holding is also strong at high levels of co-holding.

The heavy discounter variable is not significant in either specification, implying that co-holding is not simply explained by time preference. Also, the coefficient on the variable measuring unemployment expectations is negative in both specifications and statistically not significant in each case. The coefficient on the variable measuring expected future additional borrowing is also statistically not significant in both specifications. These results provide no evidence for perceived predictable labor income risk or predictable dependency on credit explaining co-holding. They do not, however, rule out the possibility that unpredictable idiosyncratic risks or expenditure risks give rise to co-holding behavior.

Table 5 presents additional estimates in which the dependent variable is in each case an indicator variable for the level of cost of co-holding. Again, there is no strong and significant age profile (apart from the 18–24 age bracket) or education leaving age profile in co-holding. Co-holding at a cost of more than £100 increases in likelihood with employment in Column 1, but the coefficient on the employed dummy is not significant in either specification for higher-cost co-holding. The coefficient

[2] This is a conservative assumption as these are households who we know incur 'unnecessary' costs. Hence, our estimates should be seen as a minimum.

Table 4
Probit model for characteristics of co-holders.

	(1) Co-holding > £1000		(2) Co-holding > £2000	
	β/SE	Margin	β/SE	Margin
Age				
18–24	−0.481**	−0.075**	−0.716**	−0.081**
	(0.216)		(0.308)	
25–34	−0.117	−0.018	−0.039	−0.004
	(0.120)		(0.135)	
35–44	−0.055	−0.009	−0.006	−0.001
	(0.111)		(0.123)	
55+	0.090	0.014	0.223*	0.025*
	(0.116)		(0.131)	
Employment				
Employed (=1)	0.104	0.016	0.121	0.014
	(0.096)		(0.108)	
Unemployed (=1)	−0.136	−0.021	0.024	0.003
	(0.218)		(0.237)	
Housing				
Homeowner without mortgage (=1)	0.035	0.005	0.067	0.008
	(0.121)		(0.138)	
Homeowner with mortgage (=1)	0.237**	0.037**	0.248**	0.028**
	(0.099)		(0.113)	
Household finances				
Household income (£10,000s)	0.447	0.070	0.631	0.071
	(0.345)		(0.403)	
Household income^2	−0.142	−0.022	−0.179	−0.020
	(0.121)		(0.137)	
Income and expenditure risk				
Expects to be unemployed (=1)	0.003	0.000	−0.070	−0.008
	(0.129)		(0.146)	
Likely to borrow more in future (=1)	−0.011	−0.002	0.043	0.005
	(0.128)		(0.141)	
Behavioral characteristics				
Literacy score (0–3)	0.038	0.006	0.055	0.006
	(0.039)		(0.044)	
Impulsive spender (=1)	0.435***	0.068***	0.430***	0.048***
	(0.100)		(0.111)	
Heavy discounter (=1)	0.110	0.017	0.085	0.010
	(0.118)		(0.131)	
Observations	2584		2584	
Pseudo R^2	0.060		0.084	
LR χ^2	98.947		111.463	
Prob > χ^2	0.000		0.000	
Baseline predicted probability	0.098		0.072	

Note: Omitted reference groups are, for *Employment*: Renter/Student/Housewife/Disabled; for *Housing*: Private renter/Social renter. Further controls for spouse employment status, gender, marital status, dependent children and education leaving age.
Standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

on the mortgaged homeownership dummy is positive and statistically significant for co-holding at a cost of more than £100 and at a cost of more than £500, but not for co-holding at a cost of more than £1000.

The sign, magnitude and statistical significant of the behavioral characteristics variables are very similar to the previous results. The financial literacy score is not statistically significant in any of the specifications. Co-holding at all levels of cost increases in likelihood with impulsiveness. The magnitudes of the marginal effects on the impulsive spender dummy variable are again large: the implied effects are 65% in Column 1, 63% in Column 2 and 86% in Column 3. The coefficients on the heavy discounter variable are again not statistically significant. Also, neither the unemployment expectation variable nor the anticipated future borrowing variable are significant in these estimates.

For robustness, in Table 6 we also re-estimate the specifications from Table 4 to allow more flexibility in the relationship between financial literacy, impulsiveness and co-holding. We augment the specification by entering the financial literacy score as a series of dummy variables instead of one continuous 0–3 variable (literacy score = 1, literacy score = 2, literacy score = 3, omitted group literacy score = 0). Similarly, the impulsive spender measure enters as two dummy variables (impulsive = agree and impulsive = disagree, omitted group = neither agree nor disagree) instead of one 1/0 dummy variable taking a value of one for agree and zero otherwise. As before, none of the literacy score variables are statistically significant.

Table 5
Probit model for characteristics of costly co-holders.

	(1) Co-holding cost > £100		(2) Co-holding cost > £500		(3) Co-holding cost > £1000	
	β/SE	Margin	β/SE	Margin	β/SE	Margin
Age						
18–24	−0.376**	−0.069**	−0.573*	−0.049*	−0.761*	−0.022*
	(0.191)		(0.312)		(0.440)	
25–34	−0.080	−0.015	−0.104	−0.009	−0.478**	−0.014**
	(0.113)		(0.151)		(0.239)	
35–44	−0.078	−0.014	0.077	0.007	0.033	0.001
	(0.106)		(0.132)		(0.189)	
55+	0.006	0.001	0.153	0.013	0.174	0.005
	(0.110)		(0.148)		(0.209)	
Employment						
Employed (=1)	0.176*	0.032*	0.046	0.004	0.131	0.004
	(0.091)		(0.121)		(0.178)	
Unemployed (=1)	−0.041	−0.007	−0.091	−0.008	0.267	0.008
	(0.198)		(0.271)		(0.339)	
Housing						
Homeowner without mortgage (=1)	0.022	0.004	0.028	0.002	0.001	0.000
	(0.113)		(0.156)		(0.212)	
Homeowner with mortgage (=1)	0.206**	0.038**	0.219*	0.019*	−0.101	−0.003
	(0.093)		(0.124)		(0.182)	
Household finances						
Household income (£10,000s)	0.373	0.068	0.290	0.025	−0.417	−0.012
	(0.322)		(0.435)		(0.701)	
Household income^2	−0.143	−0.026	−0.062	−0.005	0.183	0.005
	(0.114)		(0.148)		(0.260)	
Income and expenditure risk						
Expects to be unemployed (=1)	−0.015	−0.003	−0.010	−0.001	−0.030	−0.001
	(0.123)		(0.157)		(0.229)	
Likely to borrow more in future (=1)	0.017	0.003	0.074	0.006	0.062	0.002
	(0.121)		(0.152)		(0.218)	
Behavioral characteristics						
Literacy score (0–3)	0.039	0.007	0.014	0.001	−0.068	−0.002
	(0.037)		(0.049)		(0.069)	
Impulsive spender (=1)	0.409***	0.075***	0.389***	0.033***	0.636***	0.018***
	(0.096)		(0.120)		(0.160)	
Heavy discounter (=1)	0.046	0.008	0.162	0.014	−0.026	−0.001
	(0.115)		(0.139)		(0.209)	
Observations	2584		2584		2584	
Pseudo R^2	0.047		0.092		0.157	
LR χ^2	87.926		96.976		82.213	
Prob > χ^2	0.000		0.000		0.000	
Baseline predicted probability	0.116		0.052		0.021	

Note: Omitted reference groups are, for *Employment*: Renter/Student/Housewife/Disabled; for *Housing*: Private renter/Social renter. Further controls for spouse employment status, for gender, marital status, dependent children and education leaving age.
Standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

The impulsive = agree variable is statistically significant at the 1% level of significance in each of the specifications and the magnitude of the coefficients are very similar to before, whereas the impulsive = disagree variable is not significant in each specification. These results confirm the pattern seen in the coefficient estimates in Tables 4 and 5 that co-holding is unrelated to financial literacy, but increases in likelihood with self-reported impulsiveness.

3.2. Tobit estimates

We now present results from estimated models which explain the extent of co-holding. Table 7 shows results from two Tobit models where the dependent variable is the continuous level of co-holding (Column 1) and the continuous cost incurred due to co-holding (Column 2). Households with no co-holding are assigned a value of zero. The co-holding value is the minimum value of consumer credit or liquid savings. The set of covariates included in the model is identical to that in the previous tables, as is the inclusion of the variables capturing behavioral characteristics.

Results from estimated models in both columns are very similar, and reveal the same pattern in the coefficients as those seen in the previous estimates. The level of co-holding is increasing in employment and mortgaged homeownership

Table 6
Probit model sensitivity check.

	(1) Co-holding > £1000		(2) Co-holding > £2000	
	β/SE	Margin	β/SE	Margin
Literacy score = 1	−0.002	−0.000	0.104	0.012
	(0.143)		(0.169)	
Literacy score = 2	0.181	0.028	0.238	0.027
	(0.140)		(0.166)	
Literacy score = 3	0.072	0.011	0.189	0.021
	(0.144)		(0.168)	
Impulsive = Agree	0.441***	0.069***	0.404***	0.045***
	(0.120)		(0.132)	
Impulsive = Disagree	−0.037	−0.006	−0.068	−0.008
	(0.096)		(0.107)	

Note: Omitted groups are, for *Financial Literacy*: zero correct answers; for *Impulsivenss*: Neither disagree nor agree. Further controls as in Table 4.
Standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

and decreasing with the youngest age group. The coefficient on the financial literacy score is positive but not statistically significant in either specification.

The coefficient on the impulsive spender indicator variable is positive and statistically significant at the 1% level. The coefficient value in Column 1 implies that impulsive spending, evaluated at the means of covariates, is associated with approximately £3100 of co-holding. The coefficient value on the impulsive spender variable in Column 2, again evaluated at the means of covariates, implies impulsive spending is associated with approximately £550 of interest costs due to co-holding. As with the results in the previous tables, the coefficients on the unemployment expectation and credit use expectation variables are both statistically not significant.

For robustness, we again estimate all models where both literacy score and impulsiveness are included as dummies (results not shown). These alternative specifications do not alter the results: in the case of financial literacy answering one, two or three questions correctly is not statistically significant relative to the omitted group of zero questions answered correctly; in the case of impulsiveness, agreeing is significant at the 1% level and negative relative to the baseline of neither agreeing nor disagreeing.

3.3. Estimates for alternative comparison groups

The results presented so far show that impulsiveness is positively and significantly associated with co-holding. However, these estimates do not allow us to conclude that impulsiveness is particularly associated with co-holding as distinct from borrowing. It could be argued that the relationship we observe is between impulsiveness and borrowing and that, as borrowing is one aspect of co-holding, is what explains the positive association between impulsiveness and co-holding. The summary statistics show that both borrowers and co-holders have high levels of debt and are more likely to be impulsive.

To empirically distinguish the behavioral differences which are associated with co-holding distinct from borrowing we re-estimate a further series of probit models in which we reconfigure the control group of observations in the zero category to be borrowers only. The coefficient estimates in this revised specification predict the likelihood of a household co-holding compared with borrowing. We also estimate models for comparison with the controls groups set as the 'neither/nor' group and the savers group plus an additional comparison group which combines these groups (as the 'neither/nor' group are probably low-level savers).

Table 8 reports estimates from these additional specifications. In Column 1, where the control is borrowers, the coefficient on the financial literacy score is positive and statistically significant. The marginal effect on the literacy score implies a one-point increase in literacy raises the likelihood of co-holding by 10%. The coefficient on the 'expects to be unemployed' variable is statistically not significant and the coefficient on the 'likely to borrow more in future' variable is negative and statistically significant. These imply that co-holding versus borrowing does not arise due to an expectation of unemployment and is negatively related to the expectation of requiring additional borrowing in future. The result that co-holding is predicted by better financial literacy lends some support to the notion that co-holding arises as a planned behavior.

Columns 2 and 3 present results where the comparison groups are savers and the 'neither/nor' group, respectively. Results in Column 2 show that impulsiveness strongly predicts co-holding compared with saving alone. Importantly, impulsiveness predicts co-holding when we include a measure of impatience in the form of the 'heavy discounter' variable. The coefficient on the literacy score in statistically not significant implying co-holding compared with saving is not predicted by poor financial literacy. In contrast, results in Column 3 show co-holding compared with 'neither/'nor' is predicted by both financial literacy and impulsiveness. In additional estimates not shown, when we combine the 'neither/nor' and savers groups we find almost identical patterns to the 'standard' savers groups: the coefficient on the financial literacy variable is positive, but not statistically significant and the coefficient on the impulsive spender dummy is positive and statistically significant at the 1% level, the marginal effect indicating impulsiveness is associated with a 86% probability of being a co-holder.

Table 7
Tobit: amount of co-holding and costly co-holding.

	(1) Tobit β/SE	(2) Tobit β/SE
Age		
18–24	−2094.408*	−410.025*
	(1184.930)	(217.459)
25–34	−524.499	−77.198
	(714.736)	(130.778)
35–44	−527.080	−102.309
	(672.894)	(123.671)
55+	149.643	21.904
	(713.826)	(131.001)
Employment		
Employed (=1)	1306.946**	243.322**
	(590.621)	(108.342)
Unemployed (=1)	−173.968	−49.392
	(1273.566)	(234.672)
Housing		
Homeowner without mortgage (=1)	−88.624	−33.466
	(741.150)	(135.647)
Homeowner with mortgage (=1)	1343.101**	211.109*
	(594.864)	(108.797)
Household finances		
Household income (£10,000s)	2193.200	458.534
	(2098.595)	(386.943)
Household income^2	−721.241	−157.487
	(738.084)	(136.608)
Income and expenditure risk		
Expects to be unemployed (=1)	−632.520	−112.658
	(793.446)	(145.257)
Likely to borrow more in future (=1)	−7.057	−11.284
	(763.864)	(139.996)
Behavioral characteristics		
Literacy score (0–3)	264.091	38.502
	(238.861)	(43.761)
Impulsive spender (=1)	3079.628***	548.851***
	(611.085)	(111.971)
Heavy discounter (=1)	628.697	187.208
	(719.285)	(130.676)
Observations	2584	2584
Pseudo R^2/R^2	0.019	0.021
LR χ^2/F	158.948	151.225
Prob > χ^2/Prob > F	0.000	0.000
Baseline co-holding (£)	462.148	462.148

Dependent variable: (1) Minimum amount of co-holding with lower limit of £0 and (2) amount of high-cost co-holding with lower limit of £0.
Note: Omitted reference groups are, for *Employment*: Renter/Student/Housewife/Disabled; for *Housing*: Private renter/Social renter. Further controls for spouse employment status, for gender, marital status, dependent children and education leaving age.
Standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

We also report estimates from an unordered multinomial probit model shown in Table 8. The multinomial probit model explicitly models assignment into each of the groups, in contrast to the estimates in Table 8 which only model the bivariate relationship between co-holding and one of the other group categories. In the multinomial probit model the base is the co-holder group. Results confirm the pattern in the earlier models for financial literacy and impulsiveness. Compared with being a co-holder, financial literacy is positively associated with being a saver and negatively related to being a borrower or 'neither/nor'. Being an impulsive spender is negatively related to being a saver or 'neither/nor' but positively related to being a borrower. When we combine the 'neither/nor' and savers groups we again find the same pattern in the coefficient estimates with similar magnitudes.

4. Discussion

How should we understand these results on the role of behavioral characteristics in co-holding? Our results show that impulsiveness is positively related to co-holding (as well as borrowing). However, poor financial literacy does not predict co-holding and estimates show financial literacy increases the likelihood of co-holding as an alternative to borrowing.

Table 8
Probit models of co-holders vs. different comparison groups.

	(1) Control: borrower		(2) Control: saver		(3) Control: neither–nor	
	β/SE	Margin	β/SE	Margin	β/SE	Margin
Age						
18–24	−0.452*	−0.167*	−0.458*	−0.133*	−0.377	−0.116
	(0.266)		(0.245)		(0.245)	
25–34	−0.142	−0.052	−0.042	−0.012	−0.000	−0.000
	(0.157)		(0.146)		(0.147)	
35–44	−0.013	−0.005	−0.007	−0.002	−0.025	−0.008
	(0.147)		(0.137)		(0.139)	
55+	0.195	0.072	0.015	0.004	0.049	0.015
	(0.164)		(0.141)		(0.141)	
Employment						
Employed (=1)	−0.159	−0.059	0.220*	0.064*	0.185	0.057
	(0.139)		(0.115)		(0.114)	
Unemployed (=1)	−0.310	−0.115	0.052	0.015	−0.279	−0.086
	(0.292)		(0.271)		(0.245)	
Housing						
Homeowner without mortgage (=1)	0.713***	0.263***	−0.228	−0.066	−0.026	−0.008
	(0.176)		(0.142)		(0.140)	
Homeowner with mortgage (=1)	0.382***	0.141***	0.132	0.038	0.194	0.060
	(0.129)		(0.118)		(0.119)	
Household finances						
Household income (£10,000s)	0.444	0.164	0.603	0.175	1.588**	0.487**
	(0.624)		(0.397)		(0.682)	
Household income^2	−0.119	−0.044	−0.217	−0.063	−0.758**	−0.233**
	(0.242)		(0.140)		(0.304)	
Income and expenditure risk						
Expects to be unemployed (=1)	0.192	0.071	−0.079	−0.023	0.093	0.028
	(0.175)		(0.154)		(0.160)	
Likely to borrow more in future (=1)	−0.366**	−0.135**	0.303*	0.088*	0.094	0.029
	(0.148)		(0.174)		(0.159)	
Behavioral characteristics						
Literacy score (0–3)	0.120**	0.044**	−0.058	−0.017	0.137***	0.042***
	(0.055)		(0.049)		(0.046)	
Impulsive spender (=1)	0.069	0.026	0.745***	0.216***	0.579***	0.178***
	(0.123)		(0.131)		(0.127)	
Heavy discounter (=1)	−0.115	−0.043	0.305*	0.088*	0.060	0.018
	(0.146)		(0.156)		(0.153)	
Observations	790		1232		1160	
Pseudo R^2	0.120		0.094		0.105	
LR χ^2	124.315		126.088		136.744	
Prob > χ^2	0.000		0.000		0.000	
Baseline predicted probability	0.427		0.254		0.260	

Dependent variable: Binary co-holder variable.
Note: Omitted reference groups are, for *Employment*: Renter/Student/Housewife/Disabled; for *Housing*: Private renter/Social renter. Further controls for spouse employment status, for gender, marital status, dependent children and education leaving age.
Standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

This is consistent with the suggestion that co-holding is a planned behavior undertaken by financially aware households and, as such, lends some support to the accountant-shopper explanation for co-holding suggested by Bertaut et al. (2009). In their model co-holding is a rational response to the realization of impulsive spending tendencies and dependent on consumers being able to correctly predict that their future selves will not conform the preferences of their present selves. This is consistent with our results that show the strong predictive power of self-assessed impulsiveness on co-holding. At the same time, their model does not depend on limited financial ability as the co-holding equilibrium is generated even though both entities of the dual-self are fully financially aware, which again is consistent with our findings that poor financial literacy does not predict co-holding.

However, support from our results for the accountant-shopper explanation for co-holding should be offered with caveats. Firstly, in our sample only one quarter of co-holding households report impulsive spending, so an explanation for co-holding based on impulsiveness can only explain some of the observed co-holding in our data. Secondly, although our estimates include measures of perceived predictable unemployment- and income risk and we account for liquidity plus and precautionary needs by allowing for a buffer of one-month's income, we cannot rule out the possibility that unpredictable idiosyncratic risk contributes to co-holding.

Table 9
Multinomial probit model (marginal effects).

	(1) Outcome: borrower Margin/SE	(2) Outcome: saver Margin/SE	(3) Outcome: neither–nor Margin/SE
Age			
18–24	−0.011	0.065	0.008
	(0.035)	(0.050)	(0.048)
25–34	0.000	0.047	−0.040
	(0.024)	(0.036)	(0.034)
35–44	−0.009	0.018	0.007
	(0.023)	(0.035)	(0.033)
55+	−0.038	0.040	0.002
	(0.025)	(0.034)	(0.032)
Employment			
Employed (=1)	0.075***	−0.072***	−0.047*
	(0.020)	(0.027)	(0.025)
Unemployed (=1)	0.047	−0.133**	0.097*
	(0.039)	(0.057)	(0.051)
Housing			
Homeowner without mortgage (=1)	−0.167***	0.154***	0.018
	(0.025)	(0.033)	(0.031)
Homeowner with mortgage (=1)	−0.071***	0.042	−0.018
	(0.019)	(0.029)	(0.027)
Household finances			
Household income (£10,000s)	0.037	−0.043	−0.159
	(0.074)	(0.108)	(0.147)
Household income^2	−0.031	−0.008	0.108
	(0.030)	(0.046)	(0.070)
Income and expenditure risk			
Expects to be unemployed (=1)	−0.045	0.069*	−0.008
	(0.028)	(0.040)	(0.038)
Likely to borrow more in future (=1)	0.134***	−0.154***	−0.004
	(0.024)	(0.042)	(0.037)
Behavioral characteristics			
Literacy score (0–3)	−0.016**	0.068***	−0.061***
	(0.008)	(0.011)	(0.011)
Impulsive spender (=1)	0.093***	−0.153***	−0.055*
	(0.021)	(0.035)	(0.032)
Heavy discounter (=1)	0.073***	−0.092**	−0.007
	(0.024)	(0.039)	(0.036)
Observations	2584	2584	2584
Baseline predicted probability	0.170	0.362	0.333

Base group: Outcome 'Coholder'.
Note: Omitted reference groups are, for *Employment*: Renter/Student/Housewife/Disabled; for *Housing*: Private renter/Social renter. Further controls for spouse employment status, for gender, marital status, dependent children and education leaving age.
Standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Also, our cross-sectional data does not allow us to observe whether co-holding among sample households is a temporary or persistent phenomenon. This distinction is important for understanding whether impulsiveness is a short-term or long-term driver of co-holding and whether it occurs as a planned behavior or short-term financial mistake. Panel data would allow for additional insight into the dynamics of co-holding. Finally, we cannot rule out the possibility that other explanations for co-holding (such as precautionary liquidity management) might interact with financial literacy and/or impulsiveness.

Our results on the relationship between financial literacy and co-holding do provide an example, however, of how the observed relationship between financial literacy and financial behavior might create surprising counter-intuitive results. The financial literacy literature typically finds that better financial literacy is associated with better financial outcomes such as more adequate preparation for retirement, portfolio diversification and use of lower-cost credit. In our analysis, among borrowers better financial literacy is associated with co-holding behavior which appears sub-optimal but which may actually be welfare improving for consumers.

5. Conclusion

The 'co-holding puzzle' is a violation of a simple arbitrage opportunity between liquid assets and debt on the part of households in their consumer finances. It has given rise to a puzzle in the household finance literature: why does a subset of households hold high cost consumer credit and low yield liquid savings simultaneously? Various explanations have been

suggested as to why consumers engage in this behavior. In this paper we have provided new empirical evidence on the role of financial literacy and lack of self-control (or impulsiveness) in co-holding.

We have presented empirical evidence from a UK household survey which incorporated measures of financial literacy and impulsiveness. Our results show co-holding is positively associated with self-reported impulsive spending on the part of respondents, which increases the probability of co-holding by between two thirds and more than three quarters. There is no evidence that respondents who report co-holding misunderstand central tenets of consumer finance such as interest rate calculation and interest compounding.

A challenge in analyzing apparent 'puzzles' in household financial management involves not only observing apparent violations of rational behavior on the part of households, but also understanding the types of mechanisms and facilities households might utilize to accommodate tenets of their behavior which prevent them from behaving in a purely rational manner. Our results suggest a behavioral explanation might go some way to explaining observed co-holding behavior.

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